

34 Old Mill Road
Duntocher
Clydebank
Dunbartonshire
G81 6BX
Scotland

Tel (013) 8987 8891
Fax (013) 8989 0516

email mail@newacoustics.co.uk
web site www.newacoustics.co.uk

ETSU-R-97

Why it is Wrong

Dick Bowdler

July 2005

ETSU-R-97

Why it is Wrong

1 INTRODUCTION

- 1.1 ETSU-R-97 is used throughout the UK to assess wind farm noise in planning applications. It has been incorporated into PAN45 in Scotland and PPS22 in England. Nevertheless it is a thoroughly flawed document and does not deserve the prominence it has been given.
- 1.2 The conclusions of ETSU-R-97 are so badly argued as to be laughable in parts (the daytime standard is based on the principle that it does not matter if people cannot get to sleep on their patio so long as they can get to sleep in their bedrooms). It is the only standard where the permissible night time level is higher than the permissible day time level.
- 1.3 ETSU-R-97 bears no resemblance to standards used for other industrial developments. Other renewable energy developments have to meet much stricter standards. Each time the Noise Working Group that drew up the document decide that a particular standard is appropriate, they follow it up by saying (without putting forward any evidence whatsoever) that such a standard would restrict development of wind farms and so find reasons to relax it further.

2 ASSESSMENT OF THE IMPACT OF ENVIRONMENTAL NOISE

- 2.1 It seems common sense that the impact of a new noise on existing residences is related in some way to the background noise. For example if the background noise level at present is 45dBA then a level of 35dB from a new industrial source would probably be inaudible. If the background noise level at present is 20dB then an industrial noise of 35dB will clearly be heard and would be very likely to produce complaints.
- 2.2 Indeed it is normal to set a noise limit relative to the pre-existing background noise when a new industrial noise is to be introduced into a residential area. Typical planning conditions imposed by rural local authorities (and sometimes urban ones) require that the new noise be no more than 5dB above the pre-existing background. This is based on the procedure set out in British Standard 4142.
- 2.3 In fact BS4142 does not purport to be a method of assessing nuisance or amenity. It was first published in 1967 and has since been revised twice though the general principles

remain the same. It is simply a method of assessing the likelihood of complaints. Its origin is obscure and it has been the subject of endless criticism for a whole variety of reasons. But the fact is that it works. It has been and is still regularly used to assess noise impact and I do not know of one case where it has been suggested that BS4142 gave an anomalous result. Furthermore it was endorsed by DEFRA in September 1998, the department of government concerned with the environment at that time. They submitted their Noise and Nuisance Policy under Health Effect Based Noise Assessment Methods to the EU. This said that *BS4142:1997 provides a technical means of assessing whether or not 'complaints are likely'. The result of an assessment carried out to BS4142 would normally be relevant to the deliberations of any court considering whether or not a nuisance exists.*

- 2.4 BS4142 is not normally used to assess wind farms. This is done using the document ETSU-R-97 “The Assessment and Rating of Noise from Wind Farms”.
- 2.5 ETSU-R-97 was written by a Noise Working Group (NWG) of developers, noise consultants, environmental health officers and others set up in 1995 by the Department of Trade and Industry through ETSU (the Energy Technology Support Unit). The DTI’s mission is *prosperity for all by working to create the best environment for business success in the UK*. It has no brief for the protection of the environment or for the protection of the citizen from nuisance or loss of amenity. ETSU was the UK Government executive agency for energy technologies.
- 2.6 The status of ETSU-R-97 is perfectly clear. The preface says *The aim of the Working Group was to provide information and advice to developers and planners on the environmental assessment of noise from wind turbines. While the DTI facilitated the establishment of this Noise Working Group this report is not a report of Government and should not be thought of in any way as replacing the advice contained within relevant Government guidance. The report represents the consensus view of the group of experts listed below who between them have a breadth and depth of experience in assessing and controlling the environmental impact of noise from wind farms. This consensus view has been arrived at through negotiation and compromise and in recognition of the value of achieving a common approach to the assessment of noise from wind turbines.*
- 2.7 The first paragraph of the executive summary says *This document describes a framework for the measurement of wind farm noise and gives indicative noise levels thought to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable restrictions on wind farm development or adding unduly to the costs and administrative burdens on wind farm developers or local authorities.*
- 2.8 It is thus, by its own admission, not a method of assessing impact. What is more the compromise reached by the NWG is so lacking in basis, so full of unfounded assertions and so badly thought out and argued that it comes up with standards for wind farm noise that are quite unlike any other noise standards. I need to explain in some detail why this is the case so that my point can be fully understood.

3 THE NWG ARGUMENT IN ETSU

- 3.1 I have explained why the assessment method in ETSU-R-97 is not a measure of impact. I need to describe how the assessment method was developed by the NWG in order to explain how it relates to normal methods of measuring impact. The NWG starts by pointing out that the planning advice relating to noise says that the likelihood of complaints can be assessed, where the Standard is appropriate, using guidance in BS 4142: 1990. In examining whether BS4142 is appropriate for assessing wind turbine noise the NWG suggests that there are three reasons why it might not be. These are:

Wind farms are likely to be developed in largely rural areas and not in the areas to which the standard is principally addressed, namely mixed residential and industrial areas;

the scope of BS 4142 specifically precludes situations where background noise levels are below 30dB(A);

BS 4142 recommends that noise measurements should not be taken in extreme weather conditions such as high wind speed greater than 5 metres per second average ".

- 3.2 In answer to the first point they say *Although the standard is intended for use in mixed residential and industrial areas as suggested by its title, there are no obvious reasons which prevent its application in more rural areas and indeed Members of the Noise Working Group have used it in such areas.* So BS4142 is not rejected for this reason.
- 3.3 To the second point they say, after some debate, *The question that arises is: if one intends to apply the principles of BS 4142 to the protection of external amenity, and the instrumentation is available to accurately measure noise levels below 30dB(A), should a margin above background approach be pursued in low noise environments or can an absolute level be justified in such circumstances?* They leave the question to be dealt with later. I should point out that since ETSU-R-97 was published BS4142 has been revised so that low noise levels are only excluded when both the background is less than 30dB and the turbine noise is less than 35dB.
- 3.4 Whatever the NWGs answer to the third reason, and it is not very clear what that answer is, it is obvious that they accept that there is no reason to reject BS4142 at higher wind speeds because ETSU itself says that background noise should be measured at all wind speeds up to 12m/s.
- 3.5 In summary, thus far the NWG seem to find no good reason to reject BS4142 except that it leaves open the possibility of whether to adopt a limiting absolute level to be dealt with later.
- 3.6 At this point it is necessary for me to explain L_{A90} and L_{Aeq} . Noise levels can be stated in different ways. For example if a noise is fluctuating we could talk about the minimum or the maximum or the average. BS4142, in accordance with international practice, uses the

measure L_{Aeq} to describe the specific noise – that is the noise to be assessed. This is effectively an average. It is actually a logarithmic average but that is of no real significance here. Again in accordance with common practice BS4142 uses L_{A90} to define background noise. This is the level exceeded for 90% of the time, so in a ten minute period the noise level is more than the L_{A90} for an aggregate of 9 minutes. So the L_{A90} is usually close to the minimum noise level.

- 3.7 On the question of turbine noise the NWG put forward the suggestion that L_{A90} should be used to measure turbine noise. This is because the measure will eliminate other extraneous noise. For example, if a site is affected by an occasional passing car, the L_{Aeq} may be determined by the car whilst the L_{A90} may not. I have no objection to the principle of measuring turbine noise by the use of L_{A90} . This is a method I often use where the difference between the L_{Aeq} and the L_{A90} is known and constant. However, it would be much better to measure as L_{A90} and then add back 2dB (the difference between the two) to get the L_{Aeq} value so that the units remain consistent with BS4142 and other normal practice. ETSU-R-97 carries on describing turbine noise as an L_{A90} which simply leads to confusion. BS7445 (Also ISO1996) *Description and Measurement of Environmental Noise* makes it clear that environmental noise is to be described as L_{Aeq} .
- 3.8 On Page 59 ETSU-R-97 says *It is proposed that the background noise levels upon which limits are based, and the noise limits themselves, are based upon typical rather than extreme values at any given wind speed. An approach based upon extreme values would be difficult to implement as the difference in measurements between turbine noise and background would depend upon the length of time one is prepared to take data. A more sensible approach is to base limits upon typical or average levels, but to appreciate that both turbine and background noise levels can vary over several dB for the same nominal conditions.* What they are saying is that, having measured background noise levels over a period of several weeks we should take the background noise level at each wind speed as the average of all the background noise levels at that wind speed. This is completely inconsistent with normal practice and suggesting it is “sensible” is merely an unfounded assertion. In using BS4142 in the field we are generally required by local authorities to measure at the quietest part of the period in question. It is not acceptable, where traffic noise predominates, to take an average of the L_{A90} values over, for example, a whole night time period. The local authority will require the background noise in the middle of the night when it is quietest. For example

A letter from Renfrew Council in 2004 in connection with a planning application says that the impact of noise on nearby dwellings should be assessed by BS4142 and that *the background noise level for the most sensitive period that the source could operate should be used for this assessment.*

At the Portree Co-Op development it was agreed that *In accordance with BS4142 the background noise should be measured as L_{A90} and the noise from the development as L_{Aeq} . Measurements of L_{A90} over any specific period should be carried out in wind speeds less than 5m/s and during a representative part of the period including the quietest part of the period. The measurements should be made in intervals of between 5 and 15 minutes. The average and standard deviation of all the measurements should be calculated and the*

background noise taken as the average less one standard deviation.
So the level required is more or less the quietest part of a quiet night.

- 3.9 In the case of background noise dominated by wind it has been my practice to take the average and the standard deviation of a group of 10 minute measurements and to define the period L_{A90} as the average less one standard deviation. Typically this is about 4dB less than the average. Statistically 15% of the time the background noise is below this level. Unless there is a large variation between day and night time background noise I will normally use the whole 24 hour data rather than separate day and night.
- 3.10 Returning to ETSU-R-97 on page 60, continuing discussion on background noise the NWG say, *Noise from the wind farm will be limited to 5dB(A) above background for both day- and night-time. When comparing the proposed margin with the complaints criteria suggested by BS 4142 it is important to bear in mind that the LA90 descriptor is also being proposed for the turbine noise. The Leq levels can be expected to be about 1.5-2.5dB greater. An addition of 1.5-2.5dB places the margin at the upper end of the range which can be considered to be of marginal significance ie around 5dB.* What they appear to be saying is that, because turbine noise is measured as L_{A90} , the margin above background noise that is proposed is actually 7dB in normal BS4142 terms rather than the 5dB normally adopted by local authorities. There is nothing in BS4142 that suggests that 7dB is *at the upper end of the range which can be considered to be of marginal significance.* This phrase is simply an invention of the NWG.
- 3.11 Further down page 60 it says that *On balance it is considered that a margin of 5dB(A) (by which it means 7dB in BS4142 terms) will offer a reasonable degree of protection to both the internal and external environment without unduly restricting the development of wind energy which itself has other environmental benefits.* There is no foundation whatsoever for this assertion. No evidence is brought forward or referred to.
- 3.12 So the position in the argument so far is this. The NWG has decided, without any foundation, that the 5dB “marginal significance” in BS4142 could be 7dB. It has decided, against all normal practice, that the background noise level for assessment purposes ought to be the average of background levels in any particular condition rather than the lowest level. In wind controlled background noise the average is likely to be at least 4dB more than a realistic background level. So the NWG consider that 11dB over background is appropriate for wind farms as against normal practice for industrial noise of 5dB over background noise. Of course I have to bear in mind that ETSU-R-97 does not purport to offer a method of assessment of impact. So the NWG is proposing that, for wind farms, a level of noise that is likely to give rise to complaints is appropriate because of the particular public benefits of wind farms. I cannot agree with this. As I exemplify elsewhere other projects of public benefit have to meet the stricter standard of 5dB above background.
- 3.13 Not content with establishing a margin above background noise far greater than normal, the NWG, at the bottom of page 60, continues *Applying the margin above background approach to some of the very quiet areas in the UK would imply setting noise limits down to say 25-30dB(A) based upon background levels perhaps as low as 20-25dB(A).* This is

true in principle but in practice turbines generate less noise at low wind speeds and, at cut in, turbine noise might have to be limited in some areas to as little as 25dB. By the time wind speed was up to 6m/s the background noise level would be at least 25dB probably more like 30dB and so this would require turbine noise to be restricted to less than 30-35dB rather than 25-30dB. *Limits of this level would prove very restrictive on the development of wind energy.* This is simply a broad assertion. No evidence whatsoever has been adduced to demonstrate this.

- 3.14 Some measure of loss of amenity needs to be applied in low background noise levels and it is normal practice in rural Scotland (and sometimes in towns) to use BS4142 even in low background noise levels. For example:

Co-Op Retail Store, Portree in 2002. *Noise of plant from the development should not exceed the background noise level by more than 5dBA or, if the noise is tonal, should not exceed the background noise at all at any noise sensitive property.* The background noise at Home Farm Road was measured at 28dB on a calm night and this was agreed as the background noise.

New factory for Vestas at Machrihanish in 2001. At this new factory (ironically the factory that makes wind turbines) Argyll and Bute Council require that: *The rated noise level from the development shall not exceed the predetermined ambient noise level (the L90(A)) at the nearest noise sensitive properties at the former RAF housing, by more than 5dB(A). All measurements are to be taken in accordance with BS4142: 1997 with the measurement periods being 1 hour for the period 0800-2200 hours and 5 minutes for the period 2200-0800 hours.* The night time background noise was agreed at 27dB which was the lowest hourly level reached during a windless night. Earlier measurements when there was sea noise and the background was 32dB were not accepted by the council.

In 2004, SEPA, at Roslin in Midlothian, asked for a BS4142 assessment for a landfill gas generator even though the background noise level was only 27dB.

- 3.15 On page 61 the NWG say *During the night one can reasonably expect most people to be indoors and it will not be necessary to control noise to levels below those required to ensure that the restorative process of sleep is not disturbed. A night-time absolute lower limit is therefore appropriate based upon sleep disturbance criteria.* What this says is that a turbine noise level inside peoples houses of just less than the World Health Organisation say is necessary to get back to sleep if you wake up in the night is satisfactory. It seems to me this must be the very upper limit of acceptability, not one that is well balanced. Since then, the WHO has revised its guidance 5dB lower. So the ETSU night standard is now higher than WHO say you need to get back to sleep.
- 3.16 When they come to day time, on Page 62 of ETSU-R-97, it says *It is also the opinion of the Noise Working Group that there is no need to restrict noise levels below a lower absolute limit of LA90,10min = 33dB(A); if an environment is quiet enough so as not to disturb the process of falling asleep or sleep itself then it ought to be quiet enough for the*

peaceful enjoyment of one's patio or garden. This is a bizarre statement. It seems that the 33dBA is the 35dB sleep restoration level set out by the World Health Organisation for inside bedrooms at night. They seem to be saying that there is no need for noise levels during the day to be any lower than is necessary to allow you to go to sleep on your patio on a sunny afternoon.

- 3.17 Having suggested that 33dB would be satisfactory because people could get to sleep on their patio – they now say that *This level would however be a damaging constraint on the development of wind power in the UK as the large separation distances required to achieve such low noise levels would rule out most potential wind farm sites.* There is absolutely no evidence brought forward to justify this. A margin of 2km would normally easily achieve this even with the noisier modern turbines. They argue that *Wind farms have global environmental benefits which have to be weighed carefully against the local environmental impact.* So do many other things. They argue that *Wind farms do not operate on still days when the more inactive pastimes (eg sunbathing) are likely to take place.* The suggestion seems to be that the protection of people's amenity does not include protecting them whilst sunbathing in their gardens on a slightly windy day or sleeping on the patio.
- 3.18 Then, on page 63 there is another leap of credibility: *There is no evidence for or against the assertion that wind farm noise with no audible tones is acceptable up to and including LA90,10min levels of 40dB(A) even when background noise levels are 30dB or less.* This is just nonsense. There most certainly is evidence against this assertion. The 40dB is actually 42dB in BS4142 units. This is at least 12dB above background noise level of "30dB or less" and BS4142 says there are likely to be complaints at turbine levels of plus 10dB. Furthermore there is no argument that BS4142 is not applicable. Even BS 4142:1990 (which was current when ETSU-R-97 was written) might easily be applicable here. If the wind speed is 5m/s, the background noise 30dB and the turbine noise 42dB(LAeq) then there is no reason not to use BS4142, it does not exclude itself in these circumstances. This noise level is also 12dB more than (twice as loud as) the WHO considers necessary for you to be able to get to sleep.
- 3.19 They summarise this *For periods during the day the Noise Working Group has adopted the approach that external noise limits should lie somewhere between that required to avoid sleep disturbance even if the occupant is outside of the property and the higher level that would still prevent sleep disturbance inside the property.* In other words the lowest turbine noise level that they would adopt, during the day, would be high enough to prevent you getting to sleep on your patio. The highest level they adopt during the day would not quite stop you getting back to sleep in your bedroom. Presumably the principle is that, if it is too noisy to sleep outside on your patio you can be assured you will be able to get to sleep indoors.

4 CONCLUSION

- 4.1 ETSU-R-97 is so poor technically that its conclusions have to be queried. It is put together through a series of unfounded assertions and there has been no research drawn on to justify them.
- 4.2 Even if one were minded to accept the suggestion that you should use very low background noise levels and that there ought to be a level below which it would be appropriate to use an absolute noise level, the levels proposed by the NWG are not acceptable. The night time level is 45dB(L_{Aeq}) and the day time level is 37 to 42dB(L_{Aeq}). Most wind farm sites are in rural areas where background noise levels can easily be 20 to 25dBA when turbines are operating and so the margin above background could be up to 20dB or more.